DOE/ID-10430(NM)

U.S. Hydropower Resource Assessment for New Mexico

Prepared by:
Alison M. Conner
James E. Francfort

Project Manager:
Ben N. Rinehart

Published March 1997

Idaho National Engineering Laboratory
Renewable Energy Products Department
Lockheed Martin Idaho Technologies Company
Idaho Falls, Idaho 83415

Prepared for the
U.S. Department of Energy
Assistant Secretary for Energy Efficiency and Renewable Energy
Under DOE Idaho Operations Office
Contract DE-AC07-94ID13223

ABSTRACT

The U.S. Department of Energy is developing an estimate of the undeveloped hydropower potential in the United States. The Hydropower Evaluation Software (HES) is a computer model that was developed by the Idaho National Engineering Laboratory for this purpose. HES measures the undeveloped hydropower resources available in the United States, using uniform criteria for measurement. The software was developed and tested using hydropower information and data provided by the Southwestern Power Administration. It is a menu-driven program that allows the personal computer user to assign environmental attributes to potential hydropower sites, calculate development suitability factors for each site based on the environmental attributes present, and generate reports based on these suitability factors. This report describes the resource assessment results for the State of New Mexico.

ACKNOWLEDGMENTS

The authors thank Peggy A. M. Brookshier, John V. Flynn, and Wayne Belgrave of the U.S. Department of Energy and Michael McDiarmid of the State of New Mexico for their active participation and timely comments.

CONTENTS

FIGURES

TABLES

U.S. Hydropower Resource Assessment for New Mexico

INTRODUCTION

In June 1989, the U.S. Department of Energy initiated the development of a National Energy Strategy to identify the energy resources available to support the expanding demand for energy in the United States. Public hearings conducted as part of the strategy development process indicated that undeveloped hydropower resources were not well defined. As a result, the Department of Energy established an interagency Hydropower Resource Assessment Team to ascertain the undeveloped hydropower potential. In connection with these efforts by the Department of Energy, the Idaho National Engineering Laboratory designed the Hydropower Evaluation Software (HES), which has been used to perform a resource assessment of the undeveloped conventional hydropower potential in over 30 states. This report presents the results of the hydropower resource assessment for the State of New Mexico. Undeveloped pumped storage hydropower potential is not included.

The HES was developed as a tool to measure undeveloped hydropower potential regionally or by state. The software is not intended to provide precise development factors for individual sites, but to provide regional or state totals. Because the software was developed as a generic measurement tool encompassing national issues, regional and state totals must be considered judiciously; various local issues may skew undeveloped hydropower potential totals. The information for the resource assessment was compiled from the Federal Energy Regulatory Commission's Hydroelectric Power Resources Assessment database and several other sources. Refer to DOE/ID-10338, the *User's Manual* (Francfort, Matthews, Rinehart 1991) for the specifics of the software and to DOE/ID-10430.1, the *Status Report* (Conner, Francfort, Rinehart 1996) for an overview of all resource assessment activities to date.

Model Development

Hydropower Evaluation Software, both a probability-factor computer model and a database, is a menu-driven program that is intended to be user-friendly. Computer screens and report-generation capabilities were developed to meet the needs of users nationwide. The software uses environmental attribute data to generate an overall project environmental suitability factor (PESF) between 0.1 and 0.9, where 0.9 indicates the highest likelihood of development and 0.1 indicates the lowest likelihood of development. The suitability factors are dependent on the unique environmental attributes of each potential site. They reflect the considerations that (a) environmental concerns can make a potential site unacceptable, prohibiting its development (for a suitability factor of 0.1), or (b) if there are no environmental concerns, there is no negative effect on the likelihood of site development (for a suitability factor of 0.9). A combination of attributes can result in a lower suitability factor because multiple environmental considerations would reduce the likelihood that a site may be developed to its physical potential.

Model Goal

The goal of the HES is to assemble an accurate resource database of all sites with undeveloped hydropower potential in the United States for use as a planning tool to determine the viable national hydropower potential. Undeveloped hydropower potential is not limited to the development of new sites; it also includes the development of additional hydropower-generating capacity at sites that currently have hydropower, but are not developed to their full potential. This undeveloped hydropower potential is a source of nonpolluting, renewable energy available to meet the growing power needs of the United States. The HES should help make this goal obtainable and ensure a set of uniform criteria for national assessment.

Dam Status

The effects of environmental attributes vary by dam status. The dam status classifications used are as follows

W = Developed hydropower site with current power generation, but the total hydropower potential has not been fully developed. Only the undeveloped hydropower potential is discussed in this report.

W/O = Developed site without current power generation. The site has some type of developed impoundment or diversion structure, but no developed hydropower generating capability.

U = Undeveloped site. The site does not have power generation capability nor a developed impoundment or diversion structure.

ASSESSMENT RESULTS

Summary Results

A total of 22 sites (Table 1) have been identified and assessed for their undeveloped hydropower potential. The HES results for individual site capacities range from 9 kilowatts (kW) to 11 megawatts (MW). The majority of the sites (64%) have potential capacities of less than 1 MW (Figure 1).

The nonmodeled undeveloped hydropower potential total for New Mexico was identified as 90 MW. The HES results lowers this estimate about 61% to 35 MW. The greatest reduction in undeveloped hydropower potential, by MW, occurs at sites with no power generation capability, nor any type of structure (undeveloped site category). These sites have an HES-modeled undeveloped hydropower potential of 5 MW, a 26 MW reduction in the estimated undeveloped hydropower potential (Figure 2). The developed sites with power generation capability have the least percentage decrease in modeled undeveloped potential capacity. The unadjusted potential for the sites with power is 11 MW, and the modeled capacity is 6 MW, a 45% decrease in capacity (Figure 2). Figure 3 illustrates that the undeveloped sites have the smallest HES-modeled average capacity per site (0.6 MW), and the developed sites with power have the highest HES-modeled average capacity per site (3 MW). Figures 4 and 5 show examples of two sites with undeveloped hydropower potential in New Mexico.

The 22 identified sites are located within 7 major river basins. The number of sites per major river basin ranges from 1 in the Rio Penasco River Basin, to 7 in the Upper Rio Grande River Basin (Figure 6). The Upper Rio Grande River Basin has the most undeveloped hydropower potential (23 MW) of the New Mexico river basins (Figure 7). It should be noted that about one-half of 23 MW of undeveloped hydropower potential is located at one site.

Table 1. Undeveloped hydropower potential summaries for New Mexico. The table contains the nonmodeled undeveloped nameplate potential and the HES-modeled undeveloped hydropower potential totals.

	Number of projects	Nameplate potential (MW)	HES-modeled potential (MW)
With Power	2	11.0	5.5
W/O Power	12	47.9	24.3
Undeveloped	8	31.3	5.0
State Total	22	90.2	34.8

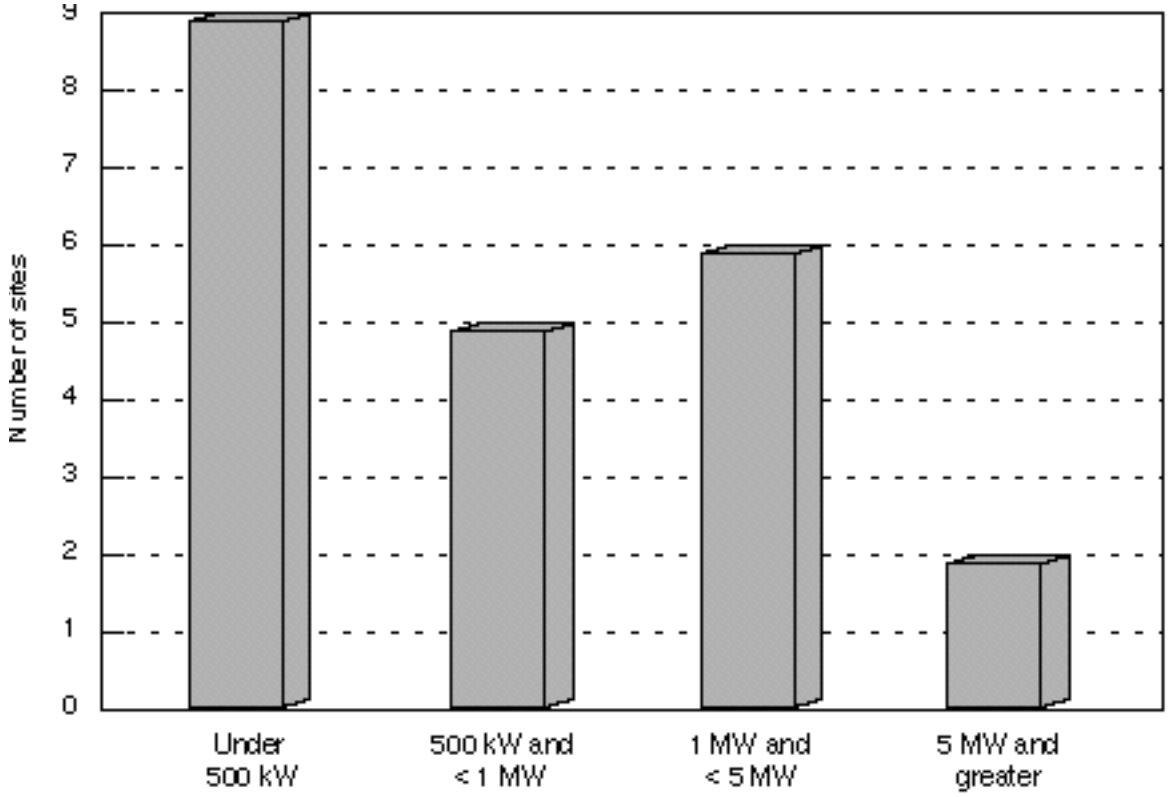

Figure 1. Number of sites, by capacity groups, with HES-modeled undeveloped hydropower potential.

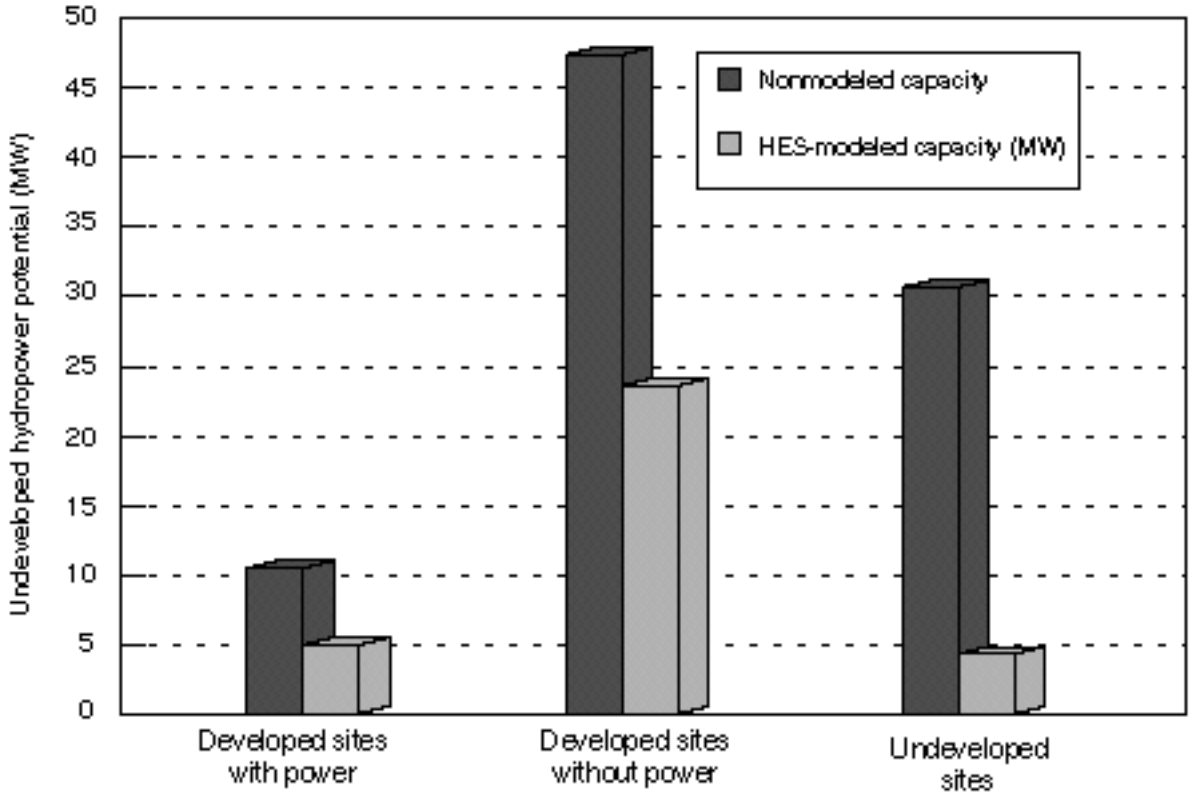

Figure 2. The nonmodeled and HES-modeled undeveloped hydropower potential.

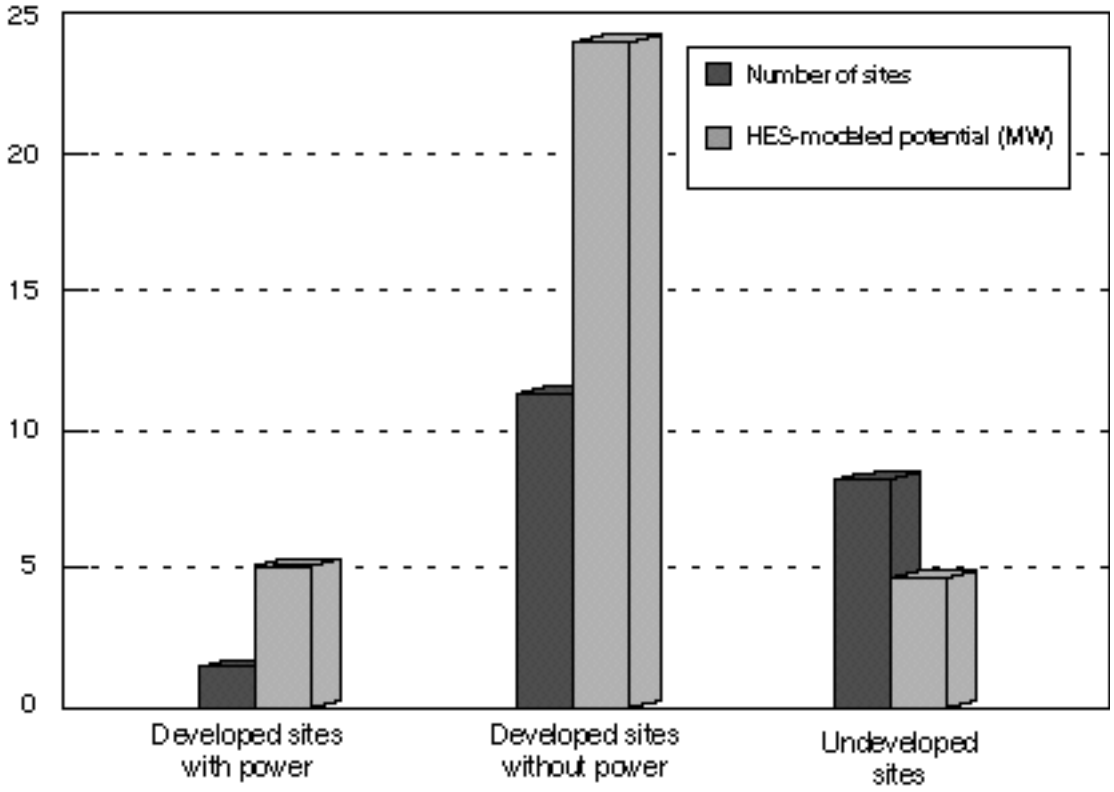

Figure 3. The number of sites with undeveloped hydropower potential and the total megawatts of HES-modeled undeveloped hydropower potential.

Figure 4. The Conchas Dam is an example of a developed site in New Mexico without current hydropower generation. It is located on the Canadian River near Tucumcari, New Mexico, and has the undeveloped hydropower potential of 2,078 kW.

Figure 5. The Ute Dam is another example of a developed site in New Mexico without current hydropower generation. It is located on the Canadian River near Tucumcari, New Mexico, and has the undeveloped hydropower potential of 2,640 kW.

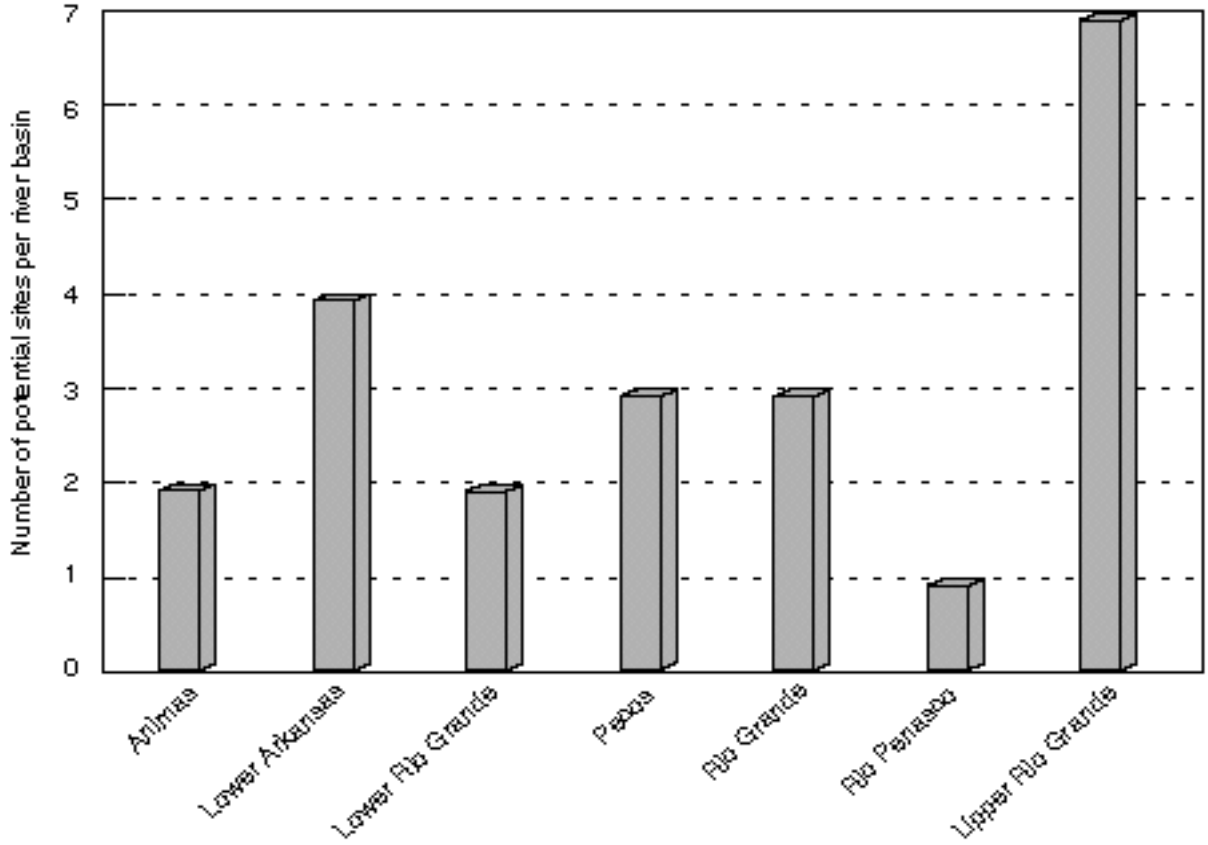

Figure 6. Number of sites with undeveloped hydropower potential in the New Mexico river basins.

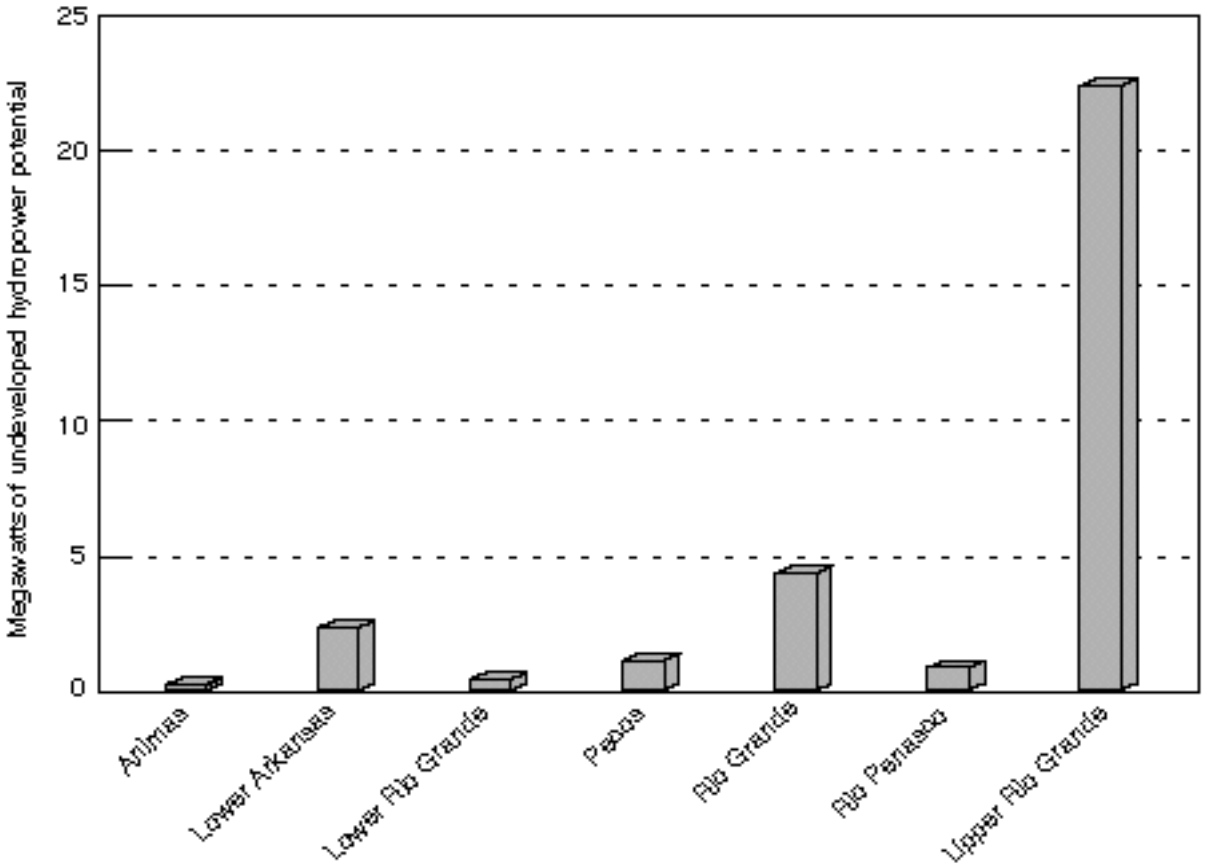

Figure 7. Megawatts of HES-modeled undeveloped hydropower potential in the New Mexico river basins.

DETAILED RESULTS

The appendices contain, in the form of HES-generated reports, detailed information about the undeveloped hydropower potential in New Mexico. The appendices contain the following information:

Appendix A summarizes the undeveloped hydropower potential by dam status groups. The number of sites, nonmodeled undeveloped hydropower potential, and HES-modeled undeveloped hydropower potential is provided based on the dam status.

Appendix B provides the hydropower resource assessment by river basin, which includes the project number, project name, stream name, dam status, nonmodeled undeveloped hydropower potential, and the HES-modeled undeveloped hydropower potential for each of the individual sites. Subtotals are provided for each river basin.

Appendix C provides the hydropower resource assessment by FERC number, which includes the project numbers, plant name, stream name, if a site is Federally owned, nonmodeled undeveloped hydropower potential, and HES-modeled undeveloped hydropower potential. The sites are grouped by dam status.

Appendix D contains a resource database list for each of the 22 sites in New Mexico. Information includes plant name, stream, state, county, river basin and owner names, project number, nameplate and HES-modeled undeveloped hydropower potential, the unit and plant types, dam status, latitude, longitude, and the environmental factors that the HES uses to determine the project environmental suitability factor.

OBTAINING INDIVIDUAL STATE INFORMATION

Additional copies of the hydropower resource assessment results for individual states are available and can be obtained by writing or

calling the authors or the National Technical Information Service (NTIS).

Telephone Orders—(703) 487-4650. NTIS sales desk and customer services are available between 8:30 a.m. and 5:00 p.m., EST.
Fax—(703) 321-8547. Customers may fax their orders to NTIS. These orders may be charged to a NTIS deposit account, American Express, VISA, or MasterCard.

Mail Orders—Mail orders should be sent to National Technical Information Service, Document Sales, 5285 Port Royal Road, Springfield, VA 22161. Call the sales desk for prices before placing an order.

Method of Payment—Customers may pay for reports (and other NTIS products and services) by (a) credit card (American Express, Visa or MasterCard); (b) check or money order on a United States bank payable to NTIS; (c) an NTIS deposit account; or, (d) by asking to be billed (add $7.50 per order), United States, Canada, and Mexico, only.

Handling Fee—A $3.00 handling fee per total order applies to orders from the United States, Canada, and Mexico. Handling charges do not apply to rush order service or pick-up orders.

Postage and Shipping—Orders are shipped first class mail, or equivalent, to addresses in the United States, Canada, and Mexico.

Order Turnaround Time—Orders for technical reports generally are shipped within 2 to 8 days of receipt. For faster service, NTIS offers rush order service.

Rush Order Service—Call 1-800-533-NTIS. In Virginia, Canada, and Mexico call (703) 487-4700. For NTIS rush order service add $15 per item. This guarantees that an order will be processed through NTIS within 24 hours of its receipt. These orders receive immediate, individual attention. The items ordered are delivered by first call mail. Call NTIS for information on rush order service for computer products.

For Help in Tracing an Order—Call (703) 487-4650 and request the customer service option.

ADDITIONAL HYDROPOWER EVALUATION SOFTWARE INFORMATION

Additional information concerning the HES can be obtained by contacting Ben Rinehart or Jim Francfort at the addresses provided below. Copies of the software and the User's Manual may also be obtained from these individuals.

Ben Rinehart, Project Manager
Idaho National Engineering and Environmental Laboratory[a]
P.O. Box 1625, MS 3830
Idaho Falls, ID 83415-3830
(208) 526-1002

Jim Francfort
Idaho National Engineering and Environmental Laboratory
P.O. Box 1625, MS 3830
Idaho Falls, ID 83415-3830
(208) 526-6787

Information concerning the State of New Mexico's involvement with the resource assessment or about the identified sites may be obtained by contacting:

Michael McDiarmid, P.E.
State of New Mexico
Energy, Minerals & Natural Resources Department
P.O. Box 6429
Santa Fe, NM 87505-5472
(505) 827-782

a. This work was performed under contract at the Idaho National Engineering Laboratory, with assistance from the State of New Mexico. In January 1997, the name of the INEL was changed to the Idaho National Engineering and Environmental Laboratory (INEEL). INEL will be used on the title page until a new INEEL logo and cover is designed. INEEL will be used throughout the text of the document, except where use of INEL is historically important (for example, p. 1).

REFERENCES

Conner, A. M., J. E. Francfort, and B. N. Rinehart, 1996, *Uniform Criteria for U.S. Hydropower Resource Assessment, Hydropower Evaluation Software Status Report-II*, DOE/ID 10430.1, Idaho National Engineering Laboratory, Idaho Falls, Idaho.

Francfort, J. E., S. D. Matthews, and B. N. Rinehart, 1991, *Hydropower Evaluation Software User's Manual*, DOE/ID-10338, Idaho National Engineering Laboratory, Idaho Falls, Idaho.